

MEMORANDUM OF UNDERSTANDING

between

JEFFERSON SCIENCE ASSOCIATES, LLC.

and

ARTEM ALIKHANYAN NATIONAL LABORATORY,

**FOR COOPERATION IN THE JEFFERSON LAB SCIENCE PROGRAM AND SCIENCE
PROJECTS OF MUTUAL INTEREST IN HALLS A, B, C AND D**

Jefferson Science Associates, LLC (JSA), the management and operating contractor of the Thomas Jefferson National Accelerator Facility (Jefferson Lab), for the United States Department of Energy (DOE), under DOE Contract No. DE-AC05-06OR23177, located at 12000 Jefferson Avenue, Newport News, Virginia 23606, and Artem Alikhanian National Laboratory (AANL), located at 2 Alikhanian Brothers Str., 0036 Yerevan, Armenia, collectively herein the "Participants",

SHARING an interest in collaborating to advance basic science research in nuclear and particle physics with the 12-GeV (billion electron volts) facility at Jefferson Lab,

HAVE REACHED THE FOLLOWING UNDERSTANDING:

I. OBJECTIVE

1. The Participants intend to collaborate on preparation, execution, data analysis and scientific publications related to nuclear science experiments in Halls A, B, C and D, in support of the Jefferson Lab 12 GeV science program.
2. The entities expected to collaborate in the activities under this Memorandum of Understanding (MOU) are as follows:

2.1 JSA is a Southeastern Universities Research Association/Pacific Architects and Engineers, Inc. (PAE), limited liability company created specifically to manage and operate Jefferson Lab. The DOE Office of Nuclear Physics within the Office of Science operates the Continuous Electron Beam Accelerator Facility (CEBAF) as a national user facility at Jefferson Lab. CEBAF is a world-leading facility in the experimental study of hadronic matter. The 12 GeV CEBAF Upgrade directly addresses a major scientific opportunity identified in both the 2002 and the 2007 Long Range Plans in which the Nuclear Science Advisory Committee of DOE and the U.S. National Science Foundation recommended the 12 GeV CEBAF Upgrade as one of the highest priorities for the program of the DOE Office of Science's Office of Nuclear Physics. The scope of the 12 GeV CEBAF Upgrade project includes upgrading the electron energy of the main accelerator from 6 GeV to 12 GeV, constructing a new experimental area (Hall D), and enhancing the capabilities in the existing experimental halls. Construction started in 2009 was completed successfully in 2017.

2.2 The AANL is a basic and applied science research laboratory, funded and managed by the Ministry of Education and Science of the Republic of Armenia. Its mission is to perform world-class theoretical and experimental research in the field of elementary particles and nuclear physics, astrophysics, cosmic ray physics, and provide scientific instrumentation and services for Armenian nuclear medicine. AANL participates in scientific collaborations worldwide, including Jefferson Lab, CERN, DESY, and SLAC. The AANL collaborations at Jefferson Lab made significant contributions to the 12 GeV CEBAF Upgrade project, specifically in development of the research programs and instrumentation in all four experimental Halls. The

AANL scientists will continue to participate in the research program of Experimental Nuclear Physics at Jefferson Lab.

II. PLANNED AREAS OF COOPERATION

Proposed collaboration may include, but is not limited to, the following:

1. AANL:

- a) Participate in Jefferson Lab research as a member of the Experimental Nuclear Science Collaborations in experimental Hall A, B, C and D, in all aspects of the operation, shift taking, detector calibration and commissioning, raw data processing and related software development,
- b) Provide support with respect to service work to maintain proper calibration and operation of the detector systems and other ancillary systems and provide corresponding documentation,
- c) Provide scientific leadership in one or several nuclear science experiments and/or scientific data analysis projects, in Halls A, B, C or D,
- d) Provide regular updates on progress and schedule to the relevant Hall Managers and other key personnel, and
- e) Participate in the design and construction of nuclear science detectors and instrumentation of relevance to the nuclear science of interest to AANL staff.

2. JSA:

- a) Provide an appropriate on-site work environment including space, computer access, necessary training, and other items for all user scientists,
- b) Keep key AANL group informed of overall project status and requirements for the joint research effort,
- c) Provide travel support for AANL group while working at Jefferson Lab. Any such support is to be implemented under an appropriate written contract,
- d) Provide emergency medical coverage for members of the AANL group stationed at Jefferson Lab. Such medical coverage should be provided for stays of any length but is not to be extended to any accompanying family members. Any such support is to be implemented under an appropriate written contract, and
- e) Other collaborative activities may be added by the Participants' mutual consent in writing.

III. FORMS OF COOPERATION

Cooperation may include, but is not limited to:

- 1. Exchange of information, publications, reports, and technical data,
- 2. Exchange of scientists, engineers, students, and other specialists for participation in project activities. Each Participant is to abide by the health, safety, and environmental requirements of the host Participant when on an exchange assignment at the host Participant's facility, and

3. Temporary loan of equipment for continued development purposes, to be implemented under a loan agreement.

IV. MECHANISMS OF COOPERATION

Key persons to act as the liaison and primary points of contact for this collaboration are as follows:

JSA: Dr. Volker Burkert, Hall B Group Leader
Dr. Cynthia Keppel, Halls A/C Group Leader
Dr. Eugene Chudakov, Hall D Group Leader

AANL: Prof. Ashot Chilingarian, AANL director
Prof. Albert Sirunyan, Head of Experimental Physics Department
Dr. Nataly Dashyan, Head of AANL Jlab group, Senior Scientist

V. GENERAL CONSIDERATIONS

1. This MOU does not create any legally binding obligations between the Participants. If commitment, obligation, or transfer of funds is required, a specific contractual agreement or other reimbursable arrangement is to be developed between JSA/Jefferson Lab and the participating_organization.
2. The conduct of cooperative activities contemplated by this MOU is subject to the availability of funding, personnel, and other resources.
3. Each Participant should conduct the cooperation contemplated by this MOU in accordance with applicable laws and regulations to which it is subject, including export control laws and regulations, and international agreements to which its Government is party.
4. Each Participant is to be responsible for the costs it incurs in participating in cooperative activities under this MOU, except as specified in separate written contracts contemplated in Section II.
5. The Participants intend to acknowledge in publications all institutions that contribute to results achieved from activities conducted under this MOU and in the manner customary for scholarly publication. Each Participant intends to utilize its institutions' review procedures for all publications (to include presentations) developed under this MOU.

VI. INTELLECTUAL PROPERTY

If the Participants decide to engage in future collaborative research and development, they intend to conclude, in good faith, a written contract to provide for the adequate protection and allocation of any intellectual property created or furnished in connection therewith.

VII. COMMENCEMENT, MODIFICATION AND DISCONTINUATION

1. Cooperative activities under this MOU may commence upon signature by the Participants and continue for a 5-year period unless discontinued in accordance with paragraph 2 of this Section VII.
2. The Participants may discontinue this MOU at any time in writing. A Participant that wishes to discontinue its participation in this MOU should endeavor to provide at least ninety (90) days written notice to the other Participant.
3. This MOU may be modified or extended by mutual written consent of the Participants.

Signed in duplicate.

For Jefferson Science Associates, LLC:

For Artem Alikhanian National Laboratory:



Stuart Henderson
Director

2/21/18

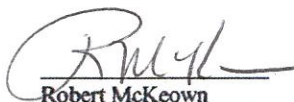
Date



Ashot Chilingarian
Director

9.02.18

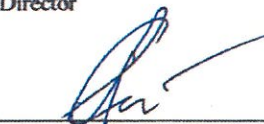
Date



Robert McKeown
Deputy Director of Science

2/19/18

Date



Albert Sirunyan
Head of Exp. Phys. Department

9/02/18

Date



Rolf Ent
Associate Director of Physics

02/14/18

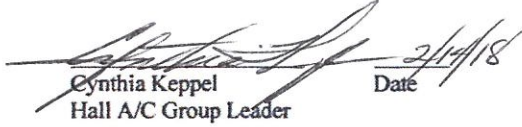
Date



Nataly Dashyan
Head of AANL JLab group

9/02/18

Date



Cynthia Keppel
Hall A/C Group Leader

2/14/18

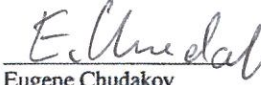
Date



Volker Burkert
Hall B Group Leader

02/12/18

Date



Eugene Chudakov
Hall D Group Leader

02/12/2018

Date